DATA PROCESSING DIGEST

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Management Decision-making Techniques

RUNNING AN OPERATIONS RESEARCH DEPARTMENT IN AN INDUSTRIAL ORGANIZATION

A. W. Swan, Courtaulds Ltd., Coventry, England
JOURNAL OF INDUSTRIAL ENGINEERING, September-October 1957; pages 269-274.

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An Operations Research Department "is essentially an internal consultancy helping management to solve any type of problem which may occur." The work of this department impinges on many other departments in the organization, and since it is impossible for the OR group to include experts from each of these departments, a team method is the logical approach for pursuing OR studies. That is, one or more members of the OR department form a team with one or more members of the operating department which is being assisted. Therefore, in building up the OR staff "it is not necessary or even advisable to try to have too many members who are expert in the organization's activities." The staff should "include both mathematical and technical knowledge, with a continuous exchange between the technological and the mathematical members...." The lack of formally educated OR personnel suggests that men and women be selected with the desired training in mathematics or statistics, and personality traits such as imagination, and then trained within the department in OR principles. A danger in selecting a person with very advanced mathematical knowledge is that he will be more interested in the methods he is using than in the results to be achieved through the OR study. In France this is being overcome by recruiting OR people from engineering ranks, and instructing them in the required mathematics, on the theory that engineers are oriented toward the application of theory, rather than in theory as such.

An OR job is made up of five parts: inception and planning, collection of information, analysis, report, follow-up. Of these, the important and difficult part is the first stages, particularly in the securing of correct and suitable information. Preliminary planning "may be quite lengthy and involve technical study and organizational work of a fairly considerable character." Also, "it is not possible to divide Operations Research methods into a number of water-tight

Planning stage of OR study is crucial

compartments, statistics, linear programming, etc., but...any situation is examined with a free mind, one or more of the methods available being used according to circumstances."

From the point of view of personnel relations, "it is... preferable that the bulk of the jobs should be as the result of requests for help. The O.R. Department should not be a reforming or investigating department which sets out to put everything right....but the healthy state is when the department is being overwhelmed by requests for assistance."

When a job has been started, the OR team member must be careful to keep the manager of the department asking for the OR study fully aware of what is happening, and consulted about visits to other departments for needed information. The executives of the other departments must also be consulted and kept informed of the need for information from their departments. Since there may be lags in the progress on any one job, an OR worker can probably handle several jobs at once. However, the scheduler should keep in mind the need for each worker to have time for creative thinking. Control in the OR department may be provided by a simple visible card index system, showing a progressive record of each job, and reviewed by the department head each week.

The final report of an OR investigation should be written with the original requestor in mind. It should be written in language which he can understand, with any technical or mathematical explanations confined to appendices. The report should begin with a summary containing sections on Object, Results, and Recommendations. The summary may then be followed by a full description of the method used and the results in full. A sample of such a report is given.

General Information

TRANSLINGUA: A WORLD LANGUAGE BASED ON NUMBERS

Erich Funke, State University of Iowa
OFFICE, November 1957; pages 102-106.

A number system is suggested for translating among any languages, including the most obscure. Words and frequently-used phrases would be given identical numbers in each language, then listed in a directory for each language, first by word, then cross-referenced by number. Messages could be compiled and sent in the numerical code, and decoded by the recipient with the aid of his own language directory. ((While the article does not suggest an application of electronic equipment to the system, the ease with which a computer could handle the technique immediately comes to mind.))

ELECTRONICS IN THE OFFICE

BUSINESS, November 1957; pages 87-96.

A review of computer installations in Great Britain reveals that about 16 commercial installations have been made, with prospects for next year being four or five dozen. None of the installations are of the management decision-making type, but rather base themselves on the one paying application, such as payroll. Costs are quoted as between 80,000 and 150,000 pounds, but this appears to be for hardware only. Little is said about planning, installation, and system design costs. It is expected that next year's report will give more information on actual working experience by the present users. A resume of the status of British equipment concludes the report.

AUTOMATION AND THE WHITE-COLLAR WORKER

PERSONNEL (Published by American Management Association), November-December 1957; pages 8-17.

Some conclusions are drawn about the personnel problems involved in EDP installations, based on studies in several companies. One conclusion is that there are few indications that EDP will lower the number of clerical workers needed, particularly in the smaller-scale installations. This is because of the large number of punch card handling still to be done. Such clerical activities also counteract the anticipated trend toward job upgrading. Employees in one of the companies studied appeared to consider the EDP installation as merely part of the normal change of office jobs which goes on continuously.

PRACTICAL AUTOMATION

Published by McGraw-Hill Book Co., 1957. $7.50.

Automation articles from FACTORY MANAGEMENT AND MAINTENANCE are reprinted in the book's 376 pages, with editorial comment added in the introductions to the four sections. Chapter 18 discusses the use of automatic equipment in the office aspects of production. The descriptions of actual installations, however, are confined to non-computer systems, with the exception of a picture story of an OR project which utilized a computing service center. A bibliography of articles and books in the general field of plant and office automation is included.

PROCEEDINGS, 1957 NMAA CONFERENCE

JOURNAL OF MACHINE ACCOUNTING, October 1957.

The entire issue of the JOURNAL OF MACHINE ACCOUNTING is devoted to the proceedings of the NMAA Conference, held in Chicago, June, 1957. Several of the seminars appear to have described the potentials of the large-scale computers through applications studies of an imaginary company. Reproductions of slides are included, showing flow charts and illustrations of the applications being described. ((As with many proceedings of conferences, these could benefit from a thorough editing job, to cut out excess verbiage and bring into focus the actual information and original ideas contributed to the various sessions.))

THE PUNCHED CARD ANNUAL

Published by Gille Associates, 1957. $10.50.

The sixth volume of the Punched Card Annual has included several articles on electronic data processing. These are introductory and general articles on integrated data processing and replacement of mechanical equipment with electronic equipment. A few of the large computer systems are described in general terms.

Applications

ELECTRONIC DATA PROCESSING AT ASO

PROGRAM USAGE REPLENISHMENT SYSTEM

NAVY MANAGEMENT REVIEW, November 1957; pages 7-11.

Integrated inventory control system

The Aviation Supply Office of the U.S. Navy began an EDP system study in 1951 for an inventory control application on the IBM 701. The system was subsequently redesigned and placed on the IBM 702, with present plans calling for two IBM 705's to replace the 702. The application, called PURS (Program Usage Replenishment System) provides for relating spare parts usage rates to future operations of aircraft and engines to generate requirements. These requirements are then matched against assets to determine whether there is a deficiency or excess of each part for each activity. The calculations are based on predetermined maintenance and overhaul replacement rates. The integrated approach used permits the almost simultaneous development of a number of inventory actions or reports all based on the same up-to-date currency of inventory, technical information, scheduled aircraft operations and overhauls. These include the Redistribution Schedule and Procurement Analysis; an overhaul schedule; a catalog, prepared by EDPM for field activity use; a Retention and Disposal study; and a complete line item budget. An improvement in the system is the figuring of distribution of spare parts according to the individual needs of the various activities, rather than on an overall average figure as at present. Also, distribution patterns will be developed through linear programing techniques. ((The spare parts inventory problem in the armed services is an exceedingly complex one. The Navy is tackling several aspects of the problem, including setting up a system of transaction reporting of high value parts for a monthly supply-demand review, and developing an economic purchase formula for low value parts.))

NAVY MANAGEMENT REVIEW

A monthly publication, NAVY MANAGEMENT REVIEW ((see above article)) reports on the accomplishments of the U.S. Navy, and its Bureaus, Offices, and Shore Establishments, in finding better ways of doing management jobs. The Navy has been outstanding in management improvement ideas, and shares its findings with private business as well as government agencies through this publication. It is now available to the public through the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C. The subscription rate is $1.50 per year.

AUTOMATIC DATA PROCESSING

DEPARTMENT STORE ECONOMIST, November 1957; page 122.

Burdine's in Miami, Florida, is using a point-of-sale recording system combining 43 Clary transactors and an LGP-30 computer. Sales checks are printed by the transactors as each sale is recorded by the sales clerk. The transactors punch out a paper tape which is collected from each transactor at the end of the day. The tapes are processed by the computer to provide in a few hours the complete figures for the total day's business, typed out on an electric typewriter. Advantages are faster customer service on the floor, elimination of errors from pencil arithmetic, increased selling time by clerks, and faster delivery of statistics.

Equipment

INTERROGATION IN THE BIZMAC SYSTEM

D. E. Beaulieu and C. H. Propster, Jr., RCA Corporation
IRE WESCON CONVENTION RECORD, Part IV, 1957

The Interrogation Unit of the BIZMAC System is used to extract specific information from any magnetic tape unit in the system on demand. Information requests may be grouped and processed at scheduled times, according to the other processing requirements of the system, or according to the urgency of the information request.

The Interrogation Unit consists of the electronic portion, remote printer stations, and the operator's console. In order to process an interrogation the operator must know the proper tape to select, the identifying criterion (any block of consecutive characters up to 32 within the first four items of the message. After the operator has inserted the criterion into the keyboard of the local printer, the criterion may be typed out for verification. The operator then selects the correct items within the message, and puts the tape into motion. Every message is compared with the criterion until the correct message is found. It is then automatically printed out on the Local Printer and, if desired, at any one of the remote printers. Total time for a complete interrogation is about 4-1/2 minutes.

DATATRON 220, FIRST MEDIUM-PRICED DIGITAL SYSTEM WITH FULL MAGNETIC CORE MEMORY

JOURNAL OF MACHINE ACCOUNTING, November 1957; pages 28-30.

DECISIVE BREAKTHROUGH IN COMPUTER ECONOMICS

DATAMATION, November-December 1957; pages 14-16.

Building block system for medium size computer

Datatron 220, manufactured by ElectroData Division of Burroughs, is a medium-priced system, using a building block arrangement of central computing and magnetic core memory plus numerous combinations of magnetic tape storage facilities and input-output devices. Basic speeds are 300,000 additions or subtractions, 30,000 multiplications and 15,000 divisions per minute. Up to 600-million characters of information can be filed in the core and tape storage. The command list has 94 arithmetic and decision-making commands, including 20 branching instructions.

A maximum system could include the computer, 10 magnetic tape ((Datafiles and/or standard tape)) storage units, 10 local or remote photoelectric paper tape readers, 10 local or remote typewriter or tape-punch output stations, and 7 punch-card readers, punches and line printers. Photoelectric paper tape input may be 1000 alphanumeric characters per second. Editing, scaling, format control and data translation are handled by input-output subsystems.

Both the Datafile and the Cardatron can be used as part of the Datatron 220 system.

MAGNACARD — A NEW CONCEPT IN DATA HANDLING

R. M. Hayes and J. Wiener, Magnavox Research Laboratories
IRE WESCON CONVENTION RECORD, Part IV, 1957

The Magnacard data-handling system, which is still under development, performs merging, sorting, collating, and file searching using 1 x 3-inch magnetic cards as the basic storage medium. Each card has a storage capacity of 5000 bits, recorded on 18 parallel channels. Cards are fed from cartridges to sets of revolving drums, slotted and pneumatically equipped to create a vacuum. As the cards are released from the cartridges, they cling to the drum surfaces, are read, and routed through the drums according to the program requirements. The cards then collect in receiving cartridges in the prescribed order.

AUTOMATIC TAPE PUNCHING PROGRAMMING MACHINE ANNOUNCED BY COMPTOMETER

JOURNAL OF MACHINE ACCOUNTING, November 1957; page 30.

An automatic tape punching and programing machine has been developed by Comptometer Corporation. The machine converts calculator results into punched paper tape as the operator performs calculations. A program board may be set up to punch constant data into the tape. Suggested fields of use are sales analysis, labor distribution, accounts payable, expense distribution, back order control, inventory control and order billing.

EECO LANGUAGE TRANSLATOR

COMPUTING NEWS, December 1, 1957; page 9.

Electronic Engineering Company of California has developed a magnetic tape language translator which will translate from the tape of any of the following computers to the tape of any other: Alwac IIIE; IBM 650, 701, 704, 705, I, II, and III; Univac I and II, 1103A, Univac File; Datatron 205 and 220; NCR 304; Bizmac I and II; Datamatic 1000; Philco Transac S-2000; Bendix G-15; and Royal McBee LPG-30. The translator will also accept input from paper tape, cards, analog-to-digital converters, electric typewriters, or manual keyboards. It can output to magnetic tape, line printers, paper tape, cards, or plotters.

AIR LINE RESERVATIONS SYSTEM

R. A. McAvoy, Eastern Air Lines, Miami, Florida
DATAMATION, November-December 1957; pages 9-13.

The airlines reservations problem is described, and solved in terms of the Univac File Computer with the Agent Set. ((See: DPD October 1957, Page 12.))

The Agent Set, located at the ticket reservations office, has a cartridge of 30 film slides containing timetables which may be projected on a small screen on the upper panel of the set. The reservations agent may then interrogate the computer regarding the availability of seats on the flights shown on the timetable, by operating the keyboard on the set. In addition, the set may be used to sell or cancel space, alter an inventory of backlog travel space demands, or determine the current operating status of the day's flights. Agent sets are connected with the File Computer by means of A. T. & T. equipment.

A SECOND SURVEY OF DOMESTIC ELECTRONIC DIGITAL COMPUTING SYSTEMS

Ballistic Research Laboratories Report No. 1010.
Published by Office of Technical Services, U. S. Dept. of Commerce. $7.00.

A revised and updated resume of more than 100 computers (both commercially available and specially built) is included in this report. Characteristics, descriptions, prices, and illustrations of the computers and computing systems are included. ((DPD considers this to be a very good reference book.))

Programing

COMPUTER PROGRAMS "IN ENGLISH"

Dr. Grace Murray Hopper, Remington Rand Univac
SYSTEMS MAGAZINE, September-October 1957; pages 13, 14.

Remington Rand Univac has developed Flow-Matic, an automatic programing system which can translate program instructions written in English into computer coding. The method is devised as a tool for non-programing systems personnel to enable them to prepare applications for the computer. In addition, Flow-Matic may be used to check pilot runs without a large expenditure of time on programing. Non-repetitive jobs and management reports on demand are other uses for Flow-Matic. Use of Flow-Matic for a computer program "leaves a trail of easily understood documentation," important in correcting or changing a program after it has been written. ((DPD hopes that more detailed information on this interesting development will be published in the future.))

Comment

MANAGEMENT GAMING

Training for management jobs

One of the most pressing business problems is that of training young men to become good managers. As long as managing is an art, new managers can be trained only by a long apprenticeship, during which they "get the feel" of how the business operates and how to make efficient decisions. An important justification for Operations Research is that it makes clear the structure of a decision area under study, and therefore this decision area becomes more teachable. Business management can then be taught more as a science than an art and we can hope to find a new Business Administration graduate ready to contribute to a greater degree than is now the case.

The application of more scientific techniques to the teaching of management decision-making methods is brought directly into play in "management gaming." A management game is a game in which the player is faced with a situation reasonably similar to an actual (but usually isolated) business situation, in the sense that (a) the terminology is from the business world and (b) the results of the decisions have an effect which could be expected in some businesses. The parlor game of Monopoly is probably one of the first such games, but it is intended for amusement only and is quite different from any real business situation.

One of the more successful business games is one developed by the American Management Association (reported in full in OPERATIONS RESEARCH, August 1957, under the title "On the Construction of a Multi-stage, Multi-person Business Game" by Billman, et al., pgs 469-503; all quotes are from this article). This game "simulates a competitive industrial situation wherein five companies are competing for a growing economy. The usual objectives - desired share of market and growth in total assets - provide motivation, as well as a rough measure of success, for the members of the five competing firms." Each player makes "quarterly" decisions as to plant investment, research and development expenditure, marketing, and price. The game can be played for forty quarters or so. By using an electronic computer to calculate the results of all players' decisions, one quarter can be computed in two minutes. (The process of making the decisions takes 15-25 minutes per quarter.)

Advantages of games in training managers

Such a game as this has three important advantages over the usual academic case study for training purposes:

1. The game is multi-person and for any given player all the other players are a part of the system. These other players introduce an unpredictable variation into the situation (even if the game

itself is non-stochastic, i.e., has no chance factors) which lends an aspect of reality. In fact, "a set of policies that works well in a game involving one set of players may be disastrous in a game played under the same rules but involving a different set of players with different philosophies as to optimal play."

2. The game is dynamic; the players are faced with a series of decisions, each affecting the future and correctable by future decisions only to a given extent.

3. Because the game is dynamic and unpredictable and because it has objectives similar to those of a real business (e. g., maximize increase in assets) the player becomes involved. The competition between players adds the desire to play well. This involvement is a greater incentive to learn than if the player is merely studying a written "case."

This AMA game has been played a number of times and has been generally recognized as good training in top management decision-making, providing it is accompanied by good explanatory material.

In the near future, many games will be designed for the training of management personnel. The availability of computers makes the development of "realistic" games possible, and makes playing times reasonable. For example, games for training in inventory decision-making, make-vs-buy decisions, scheduling, shop loading, allocation of sales effort, etc., are possible now (and have been developed in a few cases). With further research it may be feasible to develop games which provide realistic training in more complex decisions: selection of personnel, optimum organization, choice of marketing methods, and so on.

Some rules for designing a game

Several key points should be kept in mind in developing a "game." These are well covered in the article referred to above.

1. The basic game structure should be simple in order to make the game simple to learn. "Since simple decisions at each stage of a multi-stage process can combine to yield exceedingly complicated policies, there is no need for games of intricate local structure."

2. The information pattern is important. For example, concealing information concerning the player's own position (e. g., in the AMA game, his exact cost-vs-volume curve), the other players' positions (e. g., their current productive capacity), and the structure of the game (e. g., just how does marketing expenditure influence sales) gives the game-maker a way of controlling and modifying the game, and of making it analogous to a real management position.

3. The decision-making procedure should not require complex arithmetic calculations; it should encourage decisions based on principles.

4. The game itself should be stable; one clever move should not decide a game.

5. On the other hand the game should not be insensitive to differences in policy. A good, consistent price policy should (other factors being equal) lead to a better result (more sales) than a poor (e. g., unreasonably high) price policy.

It should be added that a real business decision area (or group of areas) can be represented for computer solution. One important technique here is simulation. The game described above is a very simplified example of simulation; actual simulation models usually take many man-months to develop, are generally quite complex, and involve lengthy computation. In general, they would not be suitable for management game purposes.

We invite correspondence on gaming as an educational tool.

Note: Arriving too late for review in this issue of DPD is a small volume titled "Top Management Decision Simulation: The AMA Approach." This is a rather complete description of the game described above, published by the American Management Association. The volume will be reviewed in a later issue.

INDEX

A subject index for Volumes 2 and 3 has been printed. Because many subscribers will not want the index, it is not included with this issue. Subscribers who want a copy may write or call the editor. There is no charge.

References

The addresses of publishers and periodicals mentioned in this issue of DATA PROCESSING DIGEST are listed below for your convenience in obtaining further information about the articles or books listed.

Business
Mercury House
109-119 Waterloo Road
London SE1, England

Computing News
12805 - 64th Avenue South
Seattle 88, Washington

DATAmation
103 Park Avenue
New York 17, New York

Department Store Economist
100 East 42nd Street
New York 17, New York

Institute of Radio Engineers (IRE)
1 East 79th Street
New York, New York

Journal of Industrial Engineering
225 North Avenue, N. W.
Atlanta, Georgia

Journal of Machine Accounting
53 West Jackson Boulevard
Chicago 4, Illinois

Mc Graw-Hill Book Company
330 West 42nd Street
New York 36, New York

Navy Management Review
Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

The Office
232 Madison Avenue
New York 16, New York

Personnel, American Management Association
1515 Broadway, Times Square
New York 36, New York

Punched Card Annual
Gille Associates
502 Macabees Building
Detroit 2, Michigan

Systems
315 Fourth Avenue
New York 10, New York

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Training

Operations Research--A Short Course, sponsored by Case Institute of Technology

Date: January 20-31, 1958
Place: Case Institute, Cleveland, Ohio
For whom: Persons who have research experience and some understanding of mathematical symbolism
Fee: $375, including materials and some meals
Information: R. L. Bell, Engineering Administration Department, Case Institute of Technology, 10900 Euclid Avenue, Cleveland, Ohio

Engineering and Management Course, University of California, Los Angeles

Date: January 27--February 6, 1958
Place: Los Angeles, California
For whom: Engineers and managers, all levels
Subjects: Operations research, electronic data processing*, management decision-making, industrial engineering, etc. Twenty-five courses in all.
Cost: $350
Information: Edward P. Coleman, Coordinator, Engineering and Management Course, College of Engineering, University of California, Los Angeles 24, California

Installing an Electronic Data Processing System (Course 20), sponsored by Canning, Sisson and Associates

Date: February 17-21, 1958
Place: Chicago (Sheraton Blackstone Hotel)
Fee: $250
Content: This course is a logical continuation of Course 10, Electronic Data Processing for Business and Industry. It is desirable, but not required, that attendees have taken Course 10 or its equivalent. Organization, Personnel, Physical Installation, Conversion, Operation.
Information: Canning, Sisson and Associates, 1140 South Robertson Blvd., Los Angeles 35, California

Electronic Data Processing for Business and Industry (Course 10), sponsored by Canning, Sisson and Associates

Date: April 14-18, 1958
Place: New York (Hotel Biltmore)
Fee, Information: See Course 20 listed above

*This course is similar in content to Canning, Sisson's "Electronic Data Processing for Business and Industry."

Installing an Electronic Data Processing System (Course 20), sponsored by Canning, Sisson and Associates

Date: May 12-16, 1958
Place: New York (Hotel Roosevelt)
Fee, Content, Information: See same course listed above

Operations Research in Production and Inventory Control, sponsored by Case Institute of Technology

Date: June 2-13, 1958
Place: Case Institute, Cleveland, Ohio
Information: R. L. Bell, Engineering Administration Department, Case Institute of Technology, 10900 Euclid Avenue, Cleveland, Ohio

TRAINING - University Courses

Certificate Program in Machine Accounting Management, sponsored by Special National Education Committee of NMAA

This program is designed for the young high school graduate or present machine operator who is interested in preparing for a career in the punch card field, or supervisors of existing installations who desire special training at the college level to better understand management problems in the preparation of statistical and accounting reports. The program is part of the regular extension division curriculum of Rutgers University. Fees range from $30.00 to $50.00 per semester. For information about the program write: E. Phillip Daro, 43 New York Avenue, Metuchen, New Jersey. For registration, write: H. S. Layton, Registrar, University Extension Division, Rutgers University, New Brunswick, New Jersey.

Meetings

"Management by Exception" Conference, sponsored by the Administrative Applications division of the American Society for Quality Control.

Date: February 7, 8, 1958
Place: Cleveland, Ohio (Carter Hotel)
Fee: $20.00 including Luncheon on February 7 and Conference Proceedings
Information: William C. Lynam, B. F. Goodrich Chemical Company 3135 Euclid Avenue, Cleveland 15, Ohio

High Speed Computer Conference (Fifth Annual)

Date: February 12-14, 1958
Place: University of Louisiana, Baton Rouge, Louisiana
Information: P. F. Boyer, Director

American Management Association Electronics Conference, and EDP Equipment Exhibit

Date: March 3-5, 1958
Place: New York (Statler Hotel)
Information: American Management Association, 1515 Broadway, Times Square, New York 36, New York

Western Joint Computer Conference

Date: May 6-9, 1958
Place: Los Angeles, California (Ambassador Hotel)
Theme: Contrasts in Computers. The last day will be devoted to Reports from the Manufacturers on small automatic computers and input/output equipment.
Information: Dr. Willis H. Ware, General Chairman, care of Rand Corp. 1700 Main Street, Santa Monica, California

Operations Research Society of America (Annual Meeting)

Date: May 15, 16, 1958
Place: Boston, Massachusetts (Sheraton-Plaza Hotel)

Canadian Computer Conference

Date: June 9, 10, 1958
Place: University of Toronto, Toronto, Canada
Information: H. J. Stowe, Manufacturers Life Insurance, 200 Bloor Street, East, Toronto 5, Ontario, Canada

International Automation Exposition and Congress

Date: June 9-13, 1958
Place: New York (Coliseum)
Information: Richard Rimbach Associates, Show Management, 845 Ridge Avenue, Pittsburgh 12, Pennsylvania

Instrument Society of America Automation Conference

Date: September 15-19, 1958
Place: Philadelphia, Pennsylvania (Convention Hall)